Appendix 1.

SECTION 2 PRACTICAL APPLICATION OF AS 1668.2

2.1 The Standard

The Australian Standard specifies ventilation requirements required for comfort, in terms of the design, installation and operation of mechanical ventilation and air conditioning systems. Minimum outdoor air requirements are tabulated for various classes of occupancy and all occupied enclosed spaces are required to be supplied with not less than the quantities specified on a per-person basis. See Table 1. (Note: some of these outdoor airflow rates differ considerably from those set out in ASHRAE 62).

The minimum outdoor air requirements specified are stated to be consensus values arrived at after consideration of published research rates used in the past, changing patterns of occupant behaviour (body odour primarily) and changing patterns of pollution emissions with the building.

The quality of indoor air is determined largely by the quality of the outdoor air entering the building. Acceptable quality of outdoor air is not well-defined. Both AS 1668.2 and ASHRAE 62 consider outdoor air generally acceptable unless deemed otherwise by the relevant local regulatory authority (such as the NSW Environment Protection Authority).

Table 1Outdoor air rates set out in AS 1668.2 for relevant occupancy types

Occupancy type	Net floor area per person if number of occupants not known m^2	Minimum outdoor airflow rate L/s person	Comments
Food and drink services			
Bars	1	20	For occupancies where smoking is not permitted, 10 L/s may be approved subject to requirements such as the display of signs, etc.
• Cabarets	1.5	20	
• Cafeterias	1	15	
• Cocktail lounges	1	20	
• Dining rooms	1.5	15	
• Fast food outlets	1	15	
• Food preparation, serving and storage	3.5	10	
Hotels, motels, resorts • Gambling casinos	1.5	15	

The values for minimum ventilation rates apply to each habitable room. AS 1668.2 and ASHRAE Standard 62 provide a calculation procedure for assessing the total outdoor air quantity required for an air handling system serving more than one enclosure. This procedure is aimed at ensuring outdoor air is introduced in correct proportion to the total supply air such that the room with the greatest outdoor air/supply air ratio is satisfied. This procedure must be adopted when designing for tenancy partitioning layouts otherwise compliance with the Standard cannot be assured and local statutory ventilation requirements will not be achieved. It is not sufficient to simply sum the outdoor air requirements for each room unless the population density and total supply air quantity are uniformly distributed.

Both Standards address variable air volume systems (which are popular in office building applications) and require the minimum ventilation rates to be maintained under all coincident operational conditions. This means that during light load periods, when supply air quantity is reduced under thermostatic control, the proportion of outdoor air/supply air

must be increased to provide correct mix of outdoor air to all the separate rooms.

• 2.2 Ventilation Concessions for Air Filters

Concessions to the outdoor air rates are available if particulate filters for air cleaning are installed in the air handling plant. The assumption is made that indoor air quality is improved if recycled air is treated. A reduction in outdoor air rate may then be achieved. Relevant factors are the quantity of recycled air treated in the plant, and the efficiency of the air cleaning device. Efficiency is to be determined by AS 1324 (formerly AS 1132) using Test dust No. 1. No standard is yet available for testing gas phase cleaning although AS 1668.2 makes provision for concessions should such a standard become available. 0_o, the percentage efficiency of the air-cleaning unit for particulates, is to be equal to or greater than 20% for a concession to apply.

Test dust No. 1 has particle sizes in the range of 0.2 to 2.0 microns; (median size is about 0.5 microns) to determine filter efficiency.

Filters used in general air conditioning applications have not been tested to particles below 0.2 microns. ETS has a significant number of particles below 0.2 microns. Therefore the efficiency of these filters to remove ETS particulates is unkown.

Those filters that cannot meet the 20% minimum criteria include the viscous impingement (sometimes called viscous oil) type, the lower quality dry fabric media and dry fabric roll type filters because of the type of media used and the difficulty in achieving a good edge seal around the filter.

Those that may meet the 20% minimum efficiency rating are:

- High quality dry fabric media
- Electrostatic precipitators
- High efficiency particulate filters (HEPA), medium efficiency particulate filters (MEPA) and ultra low penetration filters (ULPA).

The AIRAH application manual DA 15 contains descriptions and illustrations of the various filters available in the market place.

• 2.3 Filter Performance Calculations

Sample calculations (based on the current Standard) on the selection of filters to gain reductions in outdoor air flow rates are set out in Appendix 2.

2.4 Air Filters and Air Quality

While some filters are able to achieve much better than 20% on No.1 test dust under test conditions, this may not necessarily result in noticeable air quality improvement in normal public buildings. This is because there may be diffusion of outdoor, unfiltered air with the room air at door openings and other openings in the building fabric. Thus the dust load is largely determined by the occupants, ie dust brought in on shoes and clothing, from paper and furnishings, and from particles of skin and hair

• 2.5 Dilution Ventilation of Contaminants

In a typical occupied building, the ventilation strategy to control contaminants could be to provide either:

- supply-side ventilation in which outdoor air is introduced into the occupied space

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at a predetermined flow rate sufficient to dilute airborne contaminants; or

- supplementary make-up ventilation necessitated by local exhausts to remove cooking vapours or other point-source contaminants (e.g. from equipment processes, laboratories, etc.).

Codes such as AS 1668.2 are predominantly applied to supply-side ventilation systems to ensure outdoor air is well distributed for reasons of comfort. This supply-side ventilation needs to be sufficient to provide make-up for any local exhausts.

The concentration of contaminants can be calculated. Consider the example of contaminants being brought in with the outdoor air to compound the problem of contaminants generated internally.

C_o is the concentration of a contaminant inside, mg/m^3

C_i is the concentration of the same contaminant inside, mg/m^3

P is the rate of production of the contaminant in the indoor space, mg/hr

E is the rate of elimination of the contaminant by reaction, filtration, settling, etc.

V is the outdoor air flow rate m^3/hr

then

$$C_i = C_o + \frac{P - E}{V}$$

assuming, for our purposes, uniform concentration of the contaminant in the space.

Where no filtration of indoor air exists and other elimination options are negligible, this equation becomes

$$C_i = C_o + \frac{P}{V}$$

Rearranging for ventilation flow rate gives

$$V = \frac{P}{(C_i - C_o)}$$

or, if the contaminant is generated only indoors, this reduces to

$$V = \frac{P}{C_i}$$

As an example, for a typical office the amount of oxygen required is about 0.006 L/s per

person (Dunn 1989). Assuming a person consumes 25% of the available oxygen and concentration of oxygen in air is 21%

$$V = \frac{0.006}{0.21 \times 0.25} = 0.1 \text{ L/s}$$

Now take carbon dioxide which could be regarded as a contaminant if at high concentrations. Symptoms of high levels are headaches and loss of judgement. While the accepted limit for CO_2 in industrial settings is 5000 ppm (0.5%), for ventilation purposes in commercial buildings it has been generally set much lower, say 0.1%.

At a sedentary activity level, CO_2 is generated at a rate of about 0.005 L/s per person (Dunn 1989). Assuming 300 ppm (0.03%) in the outdoor air, the required ventilation for C_i = 0.1% is

$$V = \frac{P}{(C_i - C_o)}$$

$$= \frac{0.005}{0.001 - 0.0003} = 7.1 \text{ L/s}$$

Where tobacco smoking takes place, the outdoor air flow rate needs to be higher than this to reduce the discomfort effects of environmental tobacco smoke (ETS). This does not address the adverse health effects of ETS.

It has been suggested in the Supppliement to AS 1668.2 that carbon monoxide should not exceed 1 ppm. At 1 ppm of CO, one cigarette requires about 66 m^3 of fresh air (Dunn 1989). Assuming moderate smoking at a rate of two cigarettes per hour, and heavy smoking at three cigarettes per hour when one-third of occupants are smokers, outdoor air flow rates can be estimated to be, for combustion purposes

- for moderate smoking

  2 x 0.33 x 66 = 43.5 m^3/hr per person
  = 12 L/s per person

- for heavy smoking

  3 x 0.33 x 66 = 66 m^3/hr per person
  = 18 L/s per person

At a bar, 50% of occupants may be smokers and outdoor air requirement is then

3 x 0.5 x 66 = 99 m^3/hr per person
= 28 L/s per person

Outdoor rates established in AS 1668.2 (1991 version) are roughly consistent with these figures

i.e. bars - 20 L/s
casinos 15 L/s

These outdoor air rates were established on comfort criteria, and are not health-based.

- ### *2.6 Local Exhausts*

Effluents required by AS 1668.2 to be removed by dedicated local exhaust include those that are

- toxic
- irritant
- offensive

An exhaust air dilution procedure is covered in the Standard.

- ### *2.7 Air Distribution*

The supply of fresh outdoor air to a space will only be effective if adequate distribution of the air to the occupants can be ensured. The ability of this air to actually serve the occupants is called the ventilation effectiveness. Ventilation effectiveness depends on the air distribution and the location of pollution sources within the space. (Temperature of air also plays a role). If the air quality in the breathing zone is poorer than in the exhaust air then the ventilation effectiveness is reduced and more outdoor air ventilation is needed to compensate. The ASHRAE 62 Standard makes provision for ventilation effectiveness, as may also the revised AS 1668.2.

- ### *2.8 Health Effects*

ASHRAE 62 - 1989 sets out the ventilation philosophy in regard to ETS thus:

> The purpose of the Standard is to specify minimum ventilation rates and indoor air quality that will be acceptable to human occupants and are intended to avoid adverse health effects. For substantive information on health effects, the Standard must rely on recognised authorities and their specific recommendations. Therefore, with respect to tobacco smoke and other contaminants, this Standard does not, and cannot, ensure the avoidance of all possible adverse health effects, but it reflects recognised consensus criteria and guidance.

These words could well apply to AS 1668.2 which is consistent with the purpose of ASHRAE 62. Both standards have not directly addressed the ETS issue but, rather, have endeavoured to establish comfort-based design standards based primarily on results from experiments relating to odour, as mentioned.

A specific reference to smoking is contained in clause C2-3 of the Supplement (i.e. Commentary) to AS 1668.2 which states that

> "in enclosures where heavy smoking occurs, such as bars, this - i.e. particulate cleaning - will not control odours from tobacco smoking, but this is considered acceptable on the basis that occupants have a choice of whether they enter and remain for an extended period in these enclosures . . . .
>
> For an enclosure in which an excess of ETS is anticipated it is recommended that outdoor air quantities should be increased to an appropriate value. Where occupants are required by their employers to enter and remain for an extended period in such enclosures, it is recommended that ventilation systems should be designed so that the employees receive an appropriately higher amount of outdoor air."

Risks to employees are covered elsewhere throughout this Report, eg at 3.4, 4.7, 4.8 and 5.6.

2.9 *Further Comment*

AS 1668.2 is a design standard used to support the requirements of building codes. All values of outdoor air tabulated or calculated are minimum values. The Standard states:

> "The tabulated values are a consensus judgement of appropriate minima to reduce odours and other contaminants to levels acceptable to the community."

> "The requirements for ventilation air given in (the) Tables represent the minimum conditions. Values higher than (these) are sometimes recommended, taking into account the required environmental performance, and the effects of intensive smoking and various contaminants on the health and welfare of the occupants".

SECTION 3 VENTILATION AND SMOKE-FREE LEGISLATION IN THE ACT

3.1 *The Act*

Legislation in the ACT is based on the Smoke-free Areas (Enclosed Public Places) Act 1994 which prohibits smoking in enclosed public places, with some exceptions. These exceptions include smoking in outdoor areas or where the public do not go. However smoking in work areas is still subject to occupational health and safety laws and related codes of practice.

The public areas for which the legislation is contentious are: restaurants, licensed premises such as pubs, clubs and bars, and casinos. These premises are able to apply for exemptions to the smoke-free requirements on the basis of providing mechanical ventilation complying with AS 1668.2.

3.2 *Restaurants*

The Act limits smoking in restaurants. "Restaurant" means "an indoor place used primarily for the consumption of food or non-alcoholic drinks purchased on the premises".

Restaurants must either prohibit smoking entirely or be granted an exemption which requires at least 75 percent of the public area to be non-smoking.

Licensed and unlicensed restaurants are included, as are restaurants within licensed clubs. Also included are separately enclosed restaurants within smoking-prohibited premises, such as shopping malls. Smoking is not permitted in open dining areas located within smoking-prohibited premises. A 'take-away' is not a restaurant for the purposes of the Act.

3.3 *Report Form*

The exempt premises must at all times be fitted with mechanical ventilation equipment capable of maintaining air quality in accordance with Australian Standard 1668.2, and the air quality throughout the premises must meet the standards set out in AS 1668.2.

This requirement is intended to ensure that air quality standards are met in both smoking and non-smoking areas.

Air quality in AS 1668.2 is specified as the quantity of outdoor air per square metre (where the number of occupants is not known) or per person (see Section 2.3.4(a) of the Standard) for various types of premises. Table A1 in Appendix A of the Standard lists minimum outdoor air requirements for dining rooms and other classes of occupancy.

For food and drink services, which includes dining rooms, 15 litres of outdoor air per second per person (or square metre) is generally specified. Refer Table 1 in this Report. This may be reduced where smoking is prohibited and where certain types of air cleaning systems are used.

Evidence of compliance with outdoor air requirements in Table A1 of AS 1668.2 will generally be taken as evidence of compliance with the Standard.

A Building Services Engineer's Report must accompany the application for exemption. The Report Form for the Building Engineer's Statement must be signed by a practising mechanical engineer who is a Corporate Member of the Institution of Engineers Australia and is registered on the 'National Professional Engineers Register Section 3', under the

'Mechanical' category.

A copy of the "Report Form for Building Services Engineer's Statement" is attached as Appendix 3 to this report.

Application of the Act to restaurants came into effect on 6 December 1995. Although there are some 600 restaurants - cafes in the ACT all have elected to become smoke-free except for 10 restaurants which have obtained exemption. The Act (and certainly the exemption system) does not purport to guarantee that smoking-prohibited areas of exempt premises will not be subject to smoke - it only requires occupiers to take 'reasonable steps' to prevent smoke from penetrating these areas. As a result, there are ongoing complaints from non-smoking patrons of licensed restaurants and cafes who have experienced smoke exposure from non-dining areas (eg, bar areas). However, the majority of complaints received by the Department of Health during 1996 have concerned tobacco smoke exposure in those licensed premises which are not yet required to implement smoking restrictions.

3.4 Licensed Premises

In most areas of pubs, clubs, bars, hotels and other licensed premises where liquor is served, smoking is not restricted until June 1997. At that time, these premises must either prohibit smoking entirely or be granted an exemption which requires at least 50 percent of the public area to be non-smoking. The same requirements apply to the casino in Canberra.

Although these provisions for smoking (50% of licensed floor area) are more generous than for restaurants, it is anticipated by the ACT Health Department that administrative difficulties may arise for these premises due to the greater acceptance of a smoking culture.

3.5 Further Comment

Most restaurants willingly became smoke-free without fuss. A number (less than 10) applied for exemption but could not afford the heating-ventilation plant required. The complaints from several of these restaurateurs were similar and along the lines of "government interference", "yet more rules and regulations", "smoking should be completely banned to ensure there is a level playing field", etc. Virtually all the 10 complying restaurants already had in place the required ventilation equipment; none installed equipment after the date of application. It is understood however that several clubs in Canberra are carrying out extensive modifications to their premises and upgraded ventilation equipment will necessarily be included so as to meet the June 1997 application date.

In addition to meeting the requirements of the Act for the purposes of an exemption, occupiers still have occupational health and safety responsibilities, including those detailed in the ACT 'Smoke Free Workplaces Code of Practice'.

An Exemption Certificate does not eliminate the risk of claims by patrons or employees for passive smoking related illness or conditions. This means that, even with an Exemption Certificate and with mechanical ventilation equipment installed and operating, legal claims for breaches of common law or statutory responsibilities may still be brought if smoking occurs in the premises.

The Act applies only to indoor areas or areas that are entirely or substantially 'enclosed'. Outdoor seating (i.e. outside a building, in the open air) is not considered to be part of the 'dining area' for the purposes of the Act. Outdoor areas are not included when calculating

floor area.

There has been some informed criticisms of the provisions particularly regarding the concept of dividing restaurants into smoking and non-smoking areas while then seeking to apply the requirements of AS 1668.2 to protect health. Deeper issues such as off-gassing tobacco pollutants after smoking, and the ventilation system, have ceased for the working day are not covered by the methodology employed. The use of the Standard is therefore an artefact used to fulfil the need for a political compromise in the smoking debate. Because so few restaurants, in the end, chose to allow smoking it could be said that this demonstrated a degree of success in the government's handling of smoke-related health matters.

SECTION 4 THE EXPOSURE RISK

4.1 *Risk Evaluation*

In 1995 the UK Building Research Establishment released a report on the evidence for the effects on health of building fabric, services and usage patterns. The report was part of the building regulatory process and set out the relative significance of the health risks identified (BRE 1995). This section draws heavily on this study as it is one that is building-related (rather than related to public or environmental health) and therefore is of prime importance to issues of ventilation.

For non-domestic buildings, health hazards grouped in rank order of risk were found to be:

Highest risk

Radon (Note: not a significant public health issue in Australia)

Second level of risk

Environmental tobacco smoke (ETS)

- Sources of infection (e.g. food poisoning)
- Carbon monoxide

Third level of risk

- House dust mites
- Volatile organic compounds
- Lighting (i.e. light deprivation)
- Space (i.e. direct person-to-person infections)
- Hygrothermal conditions (exposure to cold)
- Fungal growth

Fourth level of risk

- Sanitary accommodation (hospitals and schools)
- Noise
- Oxides of nitrogen

No clear basis for risk assessment

- Sulphur dioxide and smoke
- Lead
- Landfill gas
- Particulates
- Pesticides
- Electromagnetic fields.

ETS, and carbon monoxide which is one of its by-products, represents the most significant health risk in non-domestic buildings, particularly as sources of infection are well covered in regulations (eg those that reference AS 3666).

4.2 The BRE Methodology

Health outcomes can range from effects on well-being, which are often transient, through to illnesses requiring varying degrees of medical attention, to serious disablement and death. The probability of a particular outcome resulting from a particular hazard also varies widely. There is less difficulty with evaluating the importance of health outcomes that are serious compared with health problems that are mild. At the other extreme, some hazards affect only a handful of very susceptible individuals, and action targeting the individuals is therefore more appropriate.

To permit a consistent comparison between building issues, a methodology has been developed which permits risks to be compared between building-related hazards to health. The methodology takes into account the 'seriousness' and the probability of the health outcomes associated with a particular hazard issue, together with the strength of the evidence that adverse health effects do occur.

The approach requires the use of terms related to risk assessment. A *hazard* is a potential cause of harm to a person, for example, low ambient temperature or high levels of carbon monoxide. A *hazardous situation* exists when a person is exposed to the hazard. The *harm* is the adverse health effect on the person which may rise from exposure to a hazard. Harm can range from trivial, such as brief discomfort, to extremely severe, including death. *Risk* is a function of (a) the probability that harm or harms will result from exposure to the hazard and (b) the severity of the harm or harms which may result.

The health risks associated with a particular hazard are summarised in a matrix. See Table 2 which shows that the order of risk for ETS is comparatively high.

Table 2Summary of ETS health risks - number of people affected in the UK per year in non-domestic buildings

	100 000+	10 000	1000 +	100 +	10 +	1 +
Class I						
Class II						
Class III						
Class IV						

This matrix describes the seriousness of the health outcomes to the individual person, the total number of people likely to be affected and the strength of evidence for a risk.

Classes I to IV correspond to different severities of health outcomes.

- Class I covers death and other 'extremely severe' outcomes; examples from the study are malignant lung cancer, regular severe pneumonia and permanent loss of consciousness.
- Class II is applied to 'severe' outcomes, for example, severe chronic confusion, mild strokes, regular severe fever and loss of consciousness for hours or days.
- Class III covers 'moderate/severe' outcomes and includes chronic severe stress, mild heart attack and regular severe migraine.
- Class IV of 'moderate' outcomes includes occasional severe discomfort, benign tumours, occasional mild pneumonia and regular serious coughs or colds.

The strength of evidence for a risk includes factors such as the type of evidence and the equality of the work from which the evidence comes. The strength of the evidence for a particular hazard-outcome relationship (as graded in Table 2) can be classified as follows.

High. A causal effect is well-established, affecting the number of people indicated. Shown as *** in the matrices.

Medium. Probable causal effect but less well-established (e.g. causal effect at extreme exposure, and indirect evidence of effect in the building environment). Shown as ** in the matrices.

Low. Possible causal effect (e.g. plausible link but with limited supporting evidence). Shown as * in the matrices.

In summary, ratings to the top and left of the matrix indicate greater importance than ratings to the bottom and right, the strength of the evidence being indicated by the number of stars in the matrix. Where more than one box in a row has been marked this reflects uncertainty as to the numbers of people affected. The *shading* on the tables represents the fact that the number of stars given also applies to boxes to the right of the starred box.

Note that the risks associated with a particular hazard may be low because current controls are working successfully: this would not be an argument for relaxing controls.

In the case of ETS, the BRE reported on

- the nature of the hazard
- the risks to health
- suggestions for preventive measures

Discussions on these issues follow.

4.3 Nature of the ETS Health Hazard

Tobacco smoke contains over 4700 different chemical constituents, both gases and particulates (Repace and Lowrey, 1992). Some of these are shown in Table 3 (Hays et al 1995). Many of these gaseous and particulate contaminants are irritants, and others are carcinogens (60 identified compounds), mutagens, and teratogens. Particles in tobacco smoke are especially hazardous because they are inhalable (0.1 to 1.0 7m) and remain airborne for hours after smoking stops. Table 3 shows that concentration of contaminants in sidestream smoke can be several times higher than those in mainstream smoke (Hays, et al 1995). The smoke given off from the burning end of the cigarette is known as 'sidestream' smoke ('mainstream' smoke is that inhaled by the smoker). Environmental tobacco smoke (ETS) consists mainly of sidestream smoke; exhaled mainstream smoke is only a minor component. More of the gas and particulate phase components are released into sidestream than mainstream smoke. The presence of the hazard is most obvious when the smoker is present in the room, but it can also arise from air movement around the building (including transmission by recirculation ventilation systems) and off-gassing from surfaces after smoking has ceased.

Nicotine is mainly in the particulate phase in mainstream smoke and mainly in the gaseous phase in sidestream cigarette smoke. The particulates (excluding nicotine and water) are known collectively as tar. Tobacco tar is carcinogenic in animal toxicity studies but it is not known precisely which combination of constituents accounts for the full carcinogenic effect. (BRE 1995).

Table 3Some Constituents of ETS (approx.)

	Concentration mg/cigarette	
	Mainstream smoke	Sidestream smoke
Tobacco burned	347	411
No of Particles	1.05×10^{12}	3.5×10^{12}
Particles - tar	10.2	34.5
- nicotine	0.46	1.27

	- phenols	0.22	0.60
Gases	- ammonia	0.16	7.4
	- carbon monoxide	18.3	86.3
	- carbon dioxide	63.5	79.5
	- formaldehyde	0.05	1.44
	- toluene	0.10	0.60
	- acetone	0.57	1.45
	- benzene	12	60

4.4 Methods of Reducing ETS Exposure

Reducing ETS exposure depends on a hierarchy of preferred control options.

The first choice for this or any air pollutant is removal of the source. For ETS this means that people stop smoking.

The second, less preferred, option is that of engineering controls. Primarily this involves

- removal of ETS by mechanical ventilation (eg smoking booths)
- use of air filters to trap tobacco smoke particles and/or gases

The next option is that of smoker - non-smoker separation.

In industrial hazard applications, the last (least preferred) option is the "safe person" approach, i.e. use of personal protective equipment. This is obviously not viable for general public area applications or activities (e.g. eating).

4.5 Effect of Ventilation in Reducing Risk

Discomfort caused by ETS can be divided into two categories: odour annoyance and irritation of mucous membranes (eyes, nose, throat). Current standards on ventilation requirements in rooms where smoking occurs are based largely on research involving subjective impressions judged by visitors immediately after entering a space. This is an empirical approach to the setting of ventilation standards, and of course, does not address the health implications.

The odour perceived in rooms where smoking occurs is caused by the present tobacco smoke and also by the background odour from substances adsorbed on room surfaces during preceding contamination and later desorbed back to the indoor air (Figure 1). Whereas the perceived odour intensity decreases with time due to adaptation, irritation increases over time (Clausen 1988). The effect is shown in Figure 2.

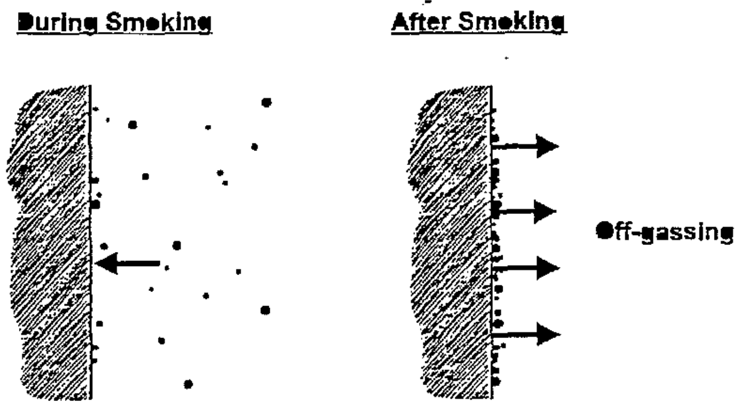

Figure 1

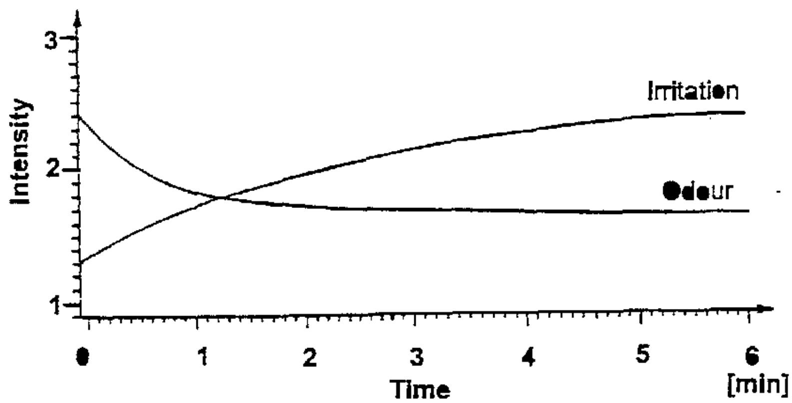

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Figure 2

In workplace environments where smoking is presently permitted (restaurants, bars, clubs, etc) exposure to ETS by non-smokers cannot be avoided. Even when smoking ceases, the effects of off-gassing continue for a considerable length of time (J. Repace of the US EPA has stated, in a private communication, that this period could be up to 2 years).

This raises the question of how much exposure to ETS is too much, and whether excessive levels of ETS can be controlled by ventilation or by air cleaning (filtering).

Repace and Lowrey (1985) carried out a study of acceptable ETS exposure based on carcinogenic risk. The study related to a typical office environment (for which smoking is generally prohibited in Australia). Exposures for employees in the hospitality industry could be expected to be similar, or greater than, those of offices.

The risk level adopted in this study corresponds to a 1 in 100,000 chance of contracting fatal lung cancer in a working lifetime of 40 years. This level matches the maximum accepted by US regulatory agencies for environmental carcinogens in air, water or food. It is a mechanism for computing extremely severe outcomes. As already mentioned, the BRE studies highlighted various levels of outcome less severe.

This procedure led to an assessment of acceptable risk applying when the daily average concentration of tobacco tar does not exceed 0.75 micrograms per cubic metre of air (0.75 7g/m^3).

The next step is to calculate the outdoor air ventilation air required to reduce the concentration down to this level.

Now AS 1668.2 generally requires an outdoor air rate of 10 to 20 L/s per person according to occupancy (see Table 1). Assuming 15 L/s for ease of calculation, a restaurant occupancy of 70 persons per 100 m^2 of floor area, a ceiling height of 3 m and that one quarter of the occupants smoke, then the smoker density is:

$$70 \times \frac{1}{3} \times \frac{1}{4}$$

$$= 5.83 \text{ smokers per } 100 \text{ m}^3 \text{ air volume}$$

The outdoor air rate required by the Standard is

$$70 \times 15 \times \frac{3600}{1000} \times \frac{1}{300} = 12.6 \text{ air changes per hour}$$

which is a large airflow rate but practicable in the restaurant application.

Repace and Lowrey (1985) have shown that the equilibrium concentration of ETS in an occupied space is $217 \times \frac{D}{C}$ where D is smoker density in persons per 100 m^3 assuming one third of the population are smokers, 217 is a constant, and C is the outdoor air ventilation rate in air changes per hour.

ATTACHMENT III

INTERNATIONAL REPORT

ATTACHMENT III

INTERNATIONAL REPORT

BACKGROUND

In 1991 in recognition of the theme of World No Tobacco Day, the World Health Organisation (WHO) reported that over half the countries in the world provide protection from smoking in public places[1]. There has been a rising tide of legislation to control tobacco use in public places, with much of it taking place since 1985. This action encompasses a range of public rights, and public health and safety laws and the WHO states that:

* Health services are protected in 40% of countries;
* Over 33% of countries have protection in entertainment establishments such as theatres and cinemas;
* Over 33% of countries have protection from smoking in schools, colleges (private and public) and in other government facilities;
* At least 20% of countries provide some protection from smoking in places where people work.

Roemer (1993)[2] reports that the number of countries or territories in which smoking in public places is controlled by legislation rose from 47 in 1987 to 90 in 1991. Moreover, numerous sub national jurisdictions -state, provinces, counties, cities and towns- have adopted legislation to ban smoking in public places. As of 1987, all but 7 states in the USA had enacted legislation restricting smoking in public places. In Canada, the provinces of Manitoba and Quebec have enacted provincial laws restricting smoking in public places.

Many local communities in Argentina, Bolivia, Brazil, Canada, France, New Zealand and the USA have enacted ordinances, some by popular vote, to make public places and workplaces within their jurisdictions smoke-free. In 1986, 39 Canadian municipalities in all ten provinces had enacted legislation to control smoking in public places and the workplace. In the USA in 1989, a total of 397 city and county smoking ordinances covered a total population of 52, 471, 053. Of these, 297 cities and counties make adoption of workplace smoking policies mandatory; 368 cities and counties control smoking in restaurants; and 298 local ordinances limit smoking in enclosed public places and/ or retail stores.

In some countries however the enforcement of laws remains a problem.

Overview of Legislation

Roemer [3] reports that countries have used various legislative approaches to ensure smoke-free public places. These approaches, with some examples of countries that have adopted them, include:

- banning smoking in all public places unless specifically allowed (Finland);
- imposing a general, comprehensive ban on smoking in all public places (Belgium, Finland, France);
- combining a general requirement restricting smoking in public places with the

designation of specific places where smoking is prohibited, e.g. places where children congregate and banks or post offices where people stay for a short time (Iceland, Norway, Sweden);

- prohibiting smoking in certain public places and authorising the designation of additional places by administrative regulations (Ireland);

- stating the general objective of banning or reducing smoking places used by the public and authorising administrative authorities to implement the legislation and designate the places where smoking is prohibited (Algeria, Ireland, Malta, Netherlands, Papua New Guinea, Senegal, Sweden);

- specifying particular public places where smoking is prohibited and authorising or urging named agencies to prohibit smoking in other public places (Brazil, Poland, Romania);

- specifying by statute or regulation particular types of places where smoking is prohibited (Bolivia, Burkina, Faso, Canada, Chile, Colombia, Costa Rica, Cyprus, Honduras, Ireland, Israel, Luxembourg, Malaysia, New Zealand, Nigeria, Saudi Arabia, Singapore. Spain, Thailand, Uruguay, Vietnam, USA).

1. Asia Pacific Countries

The following overview provides coverage of initiatives undertaken by some Asian and Pacific countries in the area of smoking restrictions in public places and in particular, the hospitality industries of those countries. Information has been drawn from a survey conducted in 1994 by the WHO Western Pacific Office.[4]

National Government Initiatives

National bans enacted by countries include the following:

Guam

1987 19th Guam Legislature. Bill No. 240. Inter alia:

Section 2: Smoking banned in 50% of public buildings and in meetings in public buildings.

Section 4: Smoking banned in more than 50% of public restaurants seating.

Malaysia

Control of Tobacco Products Regulations 1993

Article 10. No smoking areas. Smoking is prohibited in:

* air conditioned restaurants.

Flexibility is given to air con restaurants where these places are allowed to provide smoking areas not exceeding 50% of the floor space, provided they have adequate air ventilation and extraction systems.

1994 Malaysian Summonses for smoking offenders were introduced by the Malaysian Health Ministry for offenders caught smoking in areas gazetted as no-smoking zones. In 1994 officials conducted checks on 277 premises and issued warning notices on premises including 94 air-conditioned restaurants.